

REMARKS

Claims 1-6 and 25-44 are pending in the present application. Claims 1-6 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Mlcak et al. (U.S. Patent No. 5,338,416) as applied to claims 28-31 and 33-36 and further in view of Kohl et al. (U.S. Patent No. 4,369,099) or Albright et al. (U.S. Patent No. 5,578,502) as evidenced by Meyers et al. (U.S. Patent No. 4,710,589). Claims 25-27 and 32 are rejected under 35 U.S.C. § 102(b) as being anticipated by Mlcak et al. Claims 28-31 and 33-36 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Mlcak et al. Claims 37-44 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Mlcak et al. as applied to claims 28-31 and 33-36 and further in view of Kohl et al. The undersigned representative respectfully traverses the above-identified rejections.

Claims 25 and 26 have been amended by substituting "removal" for "reduction."

Rejection of Claims 25-27 and 32 Under 35 U.S.C. § 102(b)

Claims 25-27 and 32 are rejected under 35 U.S.C. § 102(b) as being anticipated by Mlcak et al. The Examiner improperly relies on Mlcak as an anticipatory reference. Claim 25 of the present application recites a "method for forming an N-type contact on an alloy-semiconductor material comprising a compound having at least a first component, the method comprising photo-electrochemical removal of the first component to form the N-type contact." (Emphasis added). Mlcak discloses "a method for micromachining three-dimensional structures from substrates having both n and p type silicon regions." Col. 1, ll. 38-40 (emphasis added). Claim 25 recites a method for forming the n type contact, and thus cannot be anticipated by the post-formation method disclosed by Mlcak. Mlcak does not disclose the method of forming the n type region and certainly does not utilize photo-electrochemical removal of a component of an

alloy-semiconductor. Instead of teaching or suggesting such a method, Mlcak assumes the existence of the n type region as a starting point for a method of micromachining.

Claims 26-27 and 32 depend on independent claim 25. Because claim 25 is believed to be allowable for the reasons set forth herein, claims dependent thereon are also allowable because they necessarily incorporate the patentable subject matter of claim 25.

**Rejection of Claims 28-31 and 33-36 under 35 U.S.C § 103(a)**

Claims 28-31 and 33-36 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Mlcak et al. Claims 28-31 and 33-41 are dependent on independent claim 25. The Examiner has rejected claim 25 under 35 U.S.C. § 102. The undersigned representative respectfully traverses the rejection of claim 25 herein. Since the limitations of claim 25 are necessarily incorporated into claims dependent therefrom, claims 28-31 and 33-41 are allowable for the reasons stated herein with respect to claim 25.

In the Detailed Action, the Examiner states:

Hence, it would have been obvious to one with ordinary skill in the art to modify Fig. 1 for the proper connection in order to use said photo-electrochemical process to accommodate specific N-type or P-type material application.

Additionally, in rejecting dependent claims 30 and 31, the Examiner states:

Wavelength of light and pH of the electrolyte solution are commonly determined by routine experiment in the art of etching, in the absence of showing criticality or unexpected results, which is different in kind and not merely in degree from the results of the prior art, it would have been obvious to one of ordinary skill in the art to determine suitable ranges through routine experimentation in order to produce an expected result.

Further, in rejecting dependent claims 29, 33, and 35, the Examiner states:

It is the Examiner's position that a person having ordinary skill in the art at the time of the instantly claimed invention would have found it obvious to modify Mlcak by adding any of same well-known features to same because these features would have been anticipated to provide their art recognized advantages and thus produce an expected result.

These above-identified statements by the Examiner are in essence the taking of Official Notice.

As required by In re Chevenard, the undersigned representative hereby seasonably challenges the Examiner's taking of Official Notice and requests that the Examiner provide objective evidence in order to establish a *prima facie* case of unpatentability. In re Chevenard, 139 F.2d 71, 60 USPQ 239 (CCPA 1943).

**Rejection of Claims 1-6 under 35 U.S.C. § 103(a)**

Claims 1-6 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Mlcak et al. (U.S. Patent No. 5,338,416) as applied to claims 28-31 and 33-36 and further in view of Kohl et al. (U.S. Patent No. 4,369,099) or Albright et al. (U.S. Patent No. 5,578,502) as evidenced by Meyers et al. (U.S. Patent No. 4,710,589). Claim 1 of the present application recites:

1. A method for the formation of rectifying junctions on alloy-semiconductors comprising the steps of:  
photo-electrochemical removal of one component of the alloy material and  
chemical etching of another component of the alloy to produce a positive-intermediate-negative (PIN) structure semiconductor.

Neither Mlcak, Kohl, or Albright teaches or suggests the photo-electrochemical removal of one component of an alloy in producing a PIN structure.

In the Detailed Action, the Examiner states that "Mlcak does not teach the chemical etching of another component of the alloy." The Examiner cites Kohl and Albright for the proposition of "using chemical etching as taught by Kohl or Albright to control the electrical properties of the product." While the Examiner is correct that Mlcak does not teach the chemical etching of another component of the alloy, the chemical etching element deficiency is not cured by Kohl and Albright.

Mlcak, Kohl, and Albright all disclose methods of forming an n or p type region that (differs from that claimed in the present application. Mlcak discloses the formation of a p-type

layer over an n type silicon substrate by in-diffusion of boron. Col. 3, ll. 55-58. Kohl discloses that methods of making p-type semiconductors involves, for example, for a III-V semiconductor, a group II element is substituted for the group III element in the III-V semiconductor. Col. 2, ll. 53-57. Albright discloses using a base substrate and depositing a n type layer and then a p type layer on the surface. Col. 2, ll. 22-59. None of these references suggest the removal of a component of an alloy; i.e., changing the chemical composition through photo-electrochemical removal of the component. Instead these references, and particularly the combination of these references, teach only the deposition of a p type structure on an n type structure or vice versa. None of these references teach the elements of claim 1. Additionally, the suggestion to combine these references is a futile effort that still does not result in the claimed subject matter.

The Examiner uses Meyers as evidence of the combination of Mlcak in view of Kohl or Albright. Meyers teaches "a method of fabrication of a p-i-n heterojunction photovoltaic cell using II-VI compound materials." Col.7, ll.18-19. This method, as described in Examples I-V, involves the deposition of compounds to form the p-i-n heterojunction. For instance, Example I of Meyers discloses the deposition of an n type CdS layer on a substrate. Col. 2, ll. 61-63; col. 7, ll. 25-26. A CdTe layer is then deposited as the intrinsic layer in the p-i-n heterojunction. Col. 2, ll. 61-64; col. 7, ll. 33-34. A ZnTe layer is then deposited for use as a p type layer. Col. 2, ll. 60-65; col. 7, ll. 40-41. Thus, Meyers may not be used to suggest a combination that teaches away from the invention of that patent. Meyers teaches using deposition of layers to obtain a p-i-n photovoltaic cell. The present application does not teach the deposition of layers, but rather the "photo-electrochemical removal of one-component of the alloy material and chemical etching of another component of the alloy."

Moreover, the Examiner rejects claims 1 – 6 as applied to the rejection of claims 28-31 and 33-36. In such a rejection, the Examiner states:

Mlcak teaches that the method may be used to etch either n or p type material. Fig. 1 shows an example of depositing material and connecting the deposited material to a terminal of a power supply, connecting an electrode disposed in an electrolyte solution to a terminal of the power supply and exposing the electrolyte solution to a light source. Hence, it would have been obvious to one with ordinary skill in the art to modify Fig. 1 for the proper connection in order to use said photo-electrochemical process to accommodate specific N-type or P-type material application.

The Examiner is correct in that Mlcak's method is used to etch either n or p type material.

However, this proposition is irrelevant to the present application. The subject of etching in Fig. 1 of Mlcak is a "silicon wafer 14 [of] a p-on-n structure with a layer of p type silicon 18 over a region of n type silicon 16." Col. 2, ll. 54-56. First, a silicon wafer is not an alloy-semiconductor material. Second, n type material is not deposited on a silicon substrate in the present application.

Claims 2-6 are dependent on independent claim 1. Because claim 1 is believed to be allowable for the reasons set forth herein, claims dependent thereon are also allowable because they necessarily incorporate the patentable subject matter of claim 1.

#### **Rejection of Claims 37-44 under 35 U.S.C. § 103(a)**

Claims 37-44 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Mlcak et al. as applied to claims 28-31 and 33-36 and further in view of Kohl et al. As stated above, claims 37-41 are dependent on claim 25, which is believed to be allowable for the reasons stated above.

Claim 42 recites:

42. A method for forming a rectifying junction on an alloy-semiconductor material comprising a compound comprising a first component and a second component, the method comprising:  
photo-electrochemical removal of the first component from a first portion of the alloy-semiconductor material to form an N-type contact; and  
removing the second component from a second portion of the alloy-semiconductor material to form a P-type contact.

According to Mlcak, a pattern of a p type region is formed by in-diffusing boron into an n type silicon substrate. Col. 3, ll. 55-58. Kohl also discloses a method of forming a p type region. The p type region of Kohl, as recited herein, involves substituting, in a III-V semiconductor for example, a group II element for the group III element and a group IV element for the group V element. Col. 2, ll. 53-62. Moreover, the Examiner states "In a method for etching P-type semiconductor, Kohl teaches using chemical etching the P-type component." However, the present application does not claim such a process. In claim 42, the present application recites "removing the second component from a second portion of the alloy-semiconductor material to form a P-type contact." (Emphasis added) Besides Kohl's method for forming a p type component as recited herein, Kohl uses chemical etching in a manner different from the present invention. Kohl teaches chemical etching a semiconductor that already has p type properties. Claim 42 of the present invention does not recite chemical etching or even the use of chemical etching to remove a p-type contact.

Even a combination of Mlcak and Kohl does not support a rejection of claim 42. The n type contact in the present application is not formed by boron in-diffusion. In contrast to Mlcak and Kohl, the present application recites "photo-electrochemical removal of the first component from a first portion of the alloy-semiconductor material to form an N-type contact."

Etching is a process distinguishable from photo-electrochemical removal. For example, claim 42 characterizes in an embodiment of the present application the photo-electrochemical removal of the first component from a first portion of an alloy-semiconductor to form an n type contact. The Mlcak reference, as stated previously herein, does not perform this function, or even suggest the procedure. In order to form the n type region in a semiconductor, the material cannot be removed by etching as stated in Mlcak. The photo-electrochemical etching of silicon, as disclosed in an embodiment of Mlcak, removes silicon from the etched location. Since silicon

is the only material in Mlcak, no material remains. In the present embodiment, a first component of a compound of an alloy-semiconductor material is removed by photo-electrochemical removal to form an n type region. If the etching procedure disclosed in Mlcak was performed in the present application, all of the alloy-semiconductor material would be removed from the region, not just a first component of a compound of the alloy-semiconductor material.

In Mlcak, the etching of semiconductor materials already containing n and p type regions is a machining process resulting in a three-dimensional structure. The photo-electrochemical removal in the present application is used to form an n type contact from a first component of the alloy-semiconductor. The "compound" in the present application is not analogous to the "silicon" or "substrate" in Mlcak. The "compound" of the alloy-semiconductor of the present invention is not limited to silicon as in Mlcak. In fact, silicon is neither a compound nor an alloy-semiconductor.

Claims 43 and 44 are dependent on independent claim 42. Because claim 42 is believed to be allowable for the reasons set forth herein, claims dependent thereon are also allowable because they necessarily incorporate the patentable subject matter of claim 42.

In rejecting dependent claims 40 and 41 in the Detailed Action, the Examiner states:

However, the composition / concentration is commonly determined by routine experiment in the art of etching, in the absence of showing criticality it would have been obvious to one of ordinary skill in the art to determine the suitable volume ration through routine experimentation in the combined prior art to produce an expected result.

This statement by the Examiner is in essence the taking of Official Notice. As required by In re Chevenard, the undersigned representative hereby seasonably challenges the Examiner's taking of Official Notice and requests that the Examiner provide objective evidence in order to establish a *prima facie* case of unpatentability. In re Chevenard, 139 F.2d 71, 60 USPQ 239 (CCPA 1943).

CONCLUSION

In light of the above remarks, it is respectfully submitted that the application is now in condition for allowance. Early notification of issuance is earnestly requested. Should the Examiner determine that any further action is necessary to place this application into better form, he is encouraged to telephone the Applicants' undersigned representative at the number listed below.

Respectfully submitted,

Date:

5/14/03

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